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ABSTRACT

The World Wide Web model has evolved within companies from a repository for notice boards to a new tool that can improve work productivity. Intranets, the internal or corporate internets, are likely to be the key information technology revolution for the remainder of this century. The intranet concept is derived from the present Internet as a natural step in its own evolution. The same TCP/IP communication protocols and applications are used, in particular the Web server/client model. This paper gives first the rationale for setting up corporate intranets, providing the main reasons why the Internet technologies are having such a remarkable impact on the scope of business networking applications and why intranets are becoming so popular among a broad variety of companies. Secondly, the key distinctive functional features of internets are presented. A discussion on typical intranet applications follows: the new functionality offered to business people and other non-typical information technology users is stressed, and significant differences with existing groupware solutions are discussed. The paper concludes by outlining a practical ongoing project to digitize documents (thus reducing the need for printed materials and allowing the inclusion of multimedia contents) which can be delivered to each desktop and accessed by all individuals of an organization in a cost-effective, flexible and friendly way through an intranet Web interface. (Author)

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The Intranet: A New Concept for Corporate Information Handling

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The intranet: a new concept for corporate information handling

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Abstract: *In the last year the World Wide Web model has evolved within companies from a repository for notice boards to a new tool that can improve work productivity. Intranets, the internal or corporate internets, are likely to be the key information technology revolution for the remainder of this century. The intranet concept is derived from the present Internet as a natural step in its own evolution. The same TCP/IP communication protocols and applications are used, in particular the Web server/client model. This paper gives first the rationale for setting up corporate intranets, providing the main reasons why the Internet technologies are having such a remarkable impact on the scope of business networking applications and why intranets are becoming so popular among a broad variety of companies. Secondly, the key distinctive functional features of intranets are presented. A discussion on typical intranet applications follows: the new functionality offered to business people and other non-typical IT users is stressed, and significant differences with existing groupware solutions are discussed. The paper ends up outlining a practical ongoing project to digitise documents (thus reducing the need for printed materials and allowing the inclusion of multimedia contents) which can be delivered to each desktop and accessed by all individuals of an organisation in a cost-effective, flexible and friendly way through an intranet Web interface.*

Keywords: database, client/server, groupware, distributed information, multimedia information, Internet, Intranet, TCP/IP, WWW, World Wide Web

1. Rationale

The Internet boom, and especially the World Wide Web (WWW) fever, has spread out in the last two years among a variety of organisations of different size and scope. Today companies have learnt that a connection to the Internet means worldwide access to many information sources — often valuable information — which may be useful for the organisation. On the other hand, publishing information and keeping in touch with customers and suppliers through the Net are new possibilities which companies see now as additional marketing channels.

In that situation, many organisations ask themselves: if the Internet is based on an open, proven and reliable technology, if there is a broad range of applications and services, and if the WWW has become a *de facto* standard to access and disseminate information world wide, why not take advantage of all that potential in order to implement internal information procedures? The intranet concept springs up thus as the evident answer to that question. Put simply, 'intranet' is the descriptive term associated with internal corporate networks which are implemented using the Internet technology and services, in particular the WWW system, but adapted to the specific physical boundaries and internal procedures of each organisation, so that certain information is available only to its employees and not to the public Internet. Implementing internal publishing procedures and other collaborative tasks on the Web via so-called intranets is proving to be simpler and more efficient, at the same time allowing easier communication with third parties.

2. Functionality of the intranet

From a functional point of view an intranet allows the immense amount of informational resources that flow within an organisation to be transported and delivered to each individual's desktop with minimal time, cost and effort. Consider this scenario. A company has 20 sites and 3000 employees who need timely access to corporate information such as company news, policy changes, training manuals, organisational procedures and the like: even to simple but crucial documents such as telephone books, pricing information and product specifications. Individual workgroups and departments require secure and limited access to confidential data. Each branch, possibly in different geographical areas, very often has its own database containing reports and data that must be shared with the head office (Refs 1, 2).

So far the normal procedure is the hard copy production and physical distribution of printed material such as

handbooks, lists, guides, etc. The production of this printed material is not only expensive and time-consuming but also highly inefficient as it needs frequent updates. And how does one guarantee that all the offices receive the information on time, quite often before it becomes obsolete? How can one ensure that people know important policy details or other relevant information that have recently changed? The straightforward answer is that with the existing technology one cannot. Nevertheless it is a proven fact that information must be kept as accurate as possible and flow rapidly in a business world which is more and more dynamic and competitive.

The answer to those problems is the Intranet for it is a solution that (Ref 1):

(a) allows the delivery of information upon demand, and when needed;

(b) can guarantee that the information is accurate and up to date;

(c) ensures that the information can be kept in a single source (although it is not necessary that source to be the only source of *all* information);

(d) allows the information to be maintained by those individuals and groups that produced it originally.

Today those problems can be solved using the generic Internet technologies which are giving rise to drastic changes: a true revolution for the information systems of the business world within the further revolution of the Internet. An intranet lowers the cost and shortens the time of distributing information. Instead of producing hard copies and delivering them by ordinary mail, documents such as newsletters, minutes, policy procedures, projects and other collaborative tasks can be stored on internal Web pages and shared by people who will peruse them at the right moment as long as they have access to the corporate intranet.

In addition to that, the intranet allows the external information existing on the World Wide Web to be organised according to the company's needs. On the internal Web server there may be links to relevant online reports and publications existing in public Web servers: for instance information about competing organisations. In summary, the intranet is becoming so popular among companies in fields so diverse as publishing, finances, insurance, healthcare, software and so on because it allows to save costs and time, to centralise information, to share internal information and to organise the information via Web pages.

3. Distinctive features of the intranet (Ref 3)

One of the key aspects of the Internet is the use of the well-known TCP/IP protocol suite to communicate between heterogeneous computer systems connected to at least one of the almost 100 000 networks that make up this worldwide information infrastructure. A similar situation can be seen, in a smaller scale, within corporate organisations: there is a great diversity of hardware and software computer resources, usually interconnected via local area networks: diversity which is also reflected on the human users and their functions.

The challenge of the Information Systems Department is to develop common platforms for the whole organisation, keeping in mind as a main goal the improvement of the company's overall productivity. The intranet concept can play an important role here as it will allow to build a powerful, flexible and portable platform for all the employees and the work functions they perform: for instance not only document search and filing but also placing orders, scheduling meetings or even keeping track of working hours.

The core of an intranet is the Web system but with additional control features to limit its use internally. The Web, though, is not the only element in an intranet: there are quite a few Internet applications based on the same technology but with peculiar aspects matched to the corporate environment. Quite often, rather than proprietary network protocols (IPX, AppleTalk, SNA, etc.) corporate LANs use the Internet IP protocol, either as the single one or co-existing with some of the others. In fact, the choice of the IP protocol in the Internet has been one of the main reasons for the success of this seamless network of networks. On top of TCP/IP one finds the traditional applications such as SMTP mail, telnet remote login, FTP file transfer, News, etc., initially Unix-based but also running on multiple platforms (DOS, MS Windows, Apple Macintosh . . .). In addition to them there are now other applications for accessing distributed multimedia information (usually based on the client/server model), the star of them being the WWW based on open standards such as the hyper-text transfer protocol (HTTP) and the hyper-text mark-up language (HTML).

In the intranet we encounter the same protocols and applications restricted to local environments. Since the available bandwidth is much greater now, a faster time delay than those usually experienced (suffered) in the global Internet is perceived and, as a consequence, the overall productivity is increased. Instead of the unbearable waiting times to fill up the screen with image-rich Web pages from remote servers, in the intranet this takes place almost instantaneously. With the same Web interface, in addition to accessing to diverse multimedia information, users can transfer files, login into databases, send e-mail messages, fill out electronic forms or participate in group discussions.

The usual case is a corporation with a head office and several local branches located in different geographical zones. The alternatives to link the various LANs are: dedicated leased lines, public data networks and the Internet. The first option is straightforward and the most secure but may be too expensive to be afforded by medium- or small-size organisations. These would rather use public data networks; Frame Relay is the obvious technical option for the network layer, as the application services are based on the Internet's TCP/IP protocol suite but without any connection to that open network (in this case the IP addresses need not be official Internet addresses).

The communication option in a corporate intranet is precisely the Internet (Figure 1). LANs are then linked via Internet Service Providers (ISP); in fact there could be more than one, even in several countries or regions. The

idea then is building private IP 'tunnels' over the global IP infrastructure of the Internet, adding the necessary security elements such as *firewalls* to isolate the internal Web server from the World Wide Web and preventing unauthorised accesses from the external world. In this way any intranet user in any corporate office throughout the world can access any corporate Web server as long as he or she has the necessary access privileges.

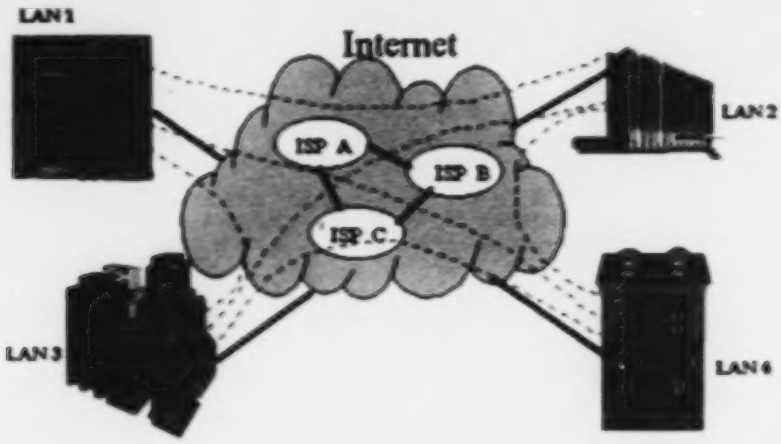

Figure 1: ISP: Internet Service Provider — private INPUT tunnels.

The last (but not least) distinctive feature of the intranet is management. That intranets use the same Internet protocols and standards does not mean that they have to follow the same (supposedly) 'chaotic' rules. In addition to security this aspect is of utmost importance for organisations that aim at building a network system to support the overall productivity, bearing in mind the annual balance sheet. According to that, access privileges of each individual and group should be carefully considered in relation to the specific jobs. Free navigation through WWW servers that hold leisure or little relevant information for the company's activities should probably be avoided by the intranet managers. Also, proxy servers and cache space should be set up in order to increase efficiency when accessing external servers frequently visited. An additional aid are the usage statistics programmes that will help intranet administrators to monitor internal use, as well as to fine tune certain parameters that may optimise the application's performance.

In summary, there are four main distinctive aspects of the intranets:

(1) The internal use of the TCP/IP protocols in corporate LANs;

(2) The Web as the common interface for all application services in internal networks with heterogeneous systems;

(3) The communication of corporate LANs via the Internet (public ISP);

(4) The management and access control procedures that have to be matched to the specific company's needs and activities.

4. Intranet applications

The use of Internet technology in private intranets, and in particular the WWW model, is profoundly affecting the corporate culture and changing the working habits presently in use. These changes take place in the different functional areas of a company, from sales and marketing departments to human resources and training units, all of them involved one way or another in the production and use of corporate information and many of them in group collaborative tasks as well. Some of the more relevant applications of this kind are (Ref 1):

- Corporate document publishing. Perhaps the most natural or immediate application in intranets as derived from the WWW publishing model. Examples of such documents are: internal newsletters, human resources guides, annual reports, price lists, product catalogues, job offers, etc. Other more restricted documents may be: meeting minutes, employee salaries, sales forecast, new product specifications and project overviews;
- Access to corporate directories and databases, for instance searching in telephone books, customer lists, bibliography, etc.;
- Workgroup applications such as project management, meeting scheduling, report writing, etc.;

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- Training courses. An intranet allows easy and efficient access (when needed) to tutorials, training materials and the like; those can be enhanced with respect to traditional methods as they may include audio and video multimedia information;
- Presentations addressed to potential corporate customers. At any given time any employee concerned can have at hand the most up to date presentation material (documents, slides . . .) that can be shown at any company site (it could be more than one site);
- E-mail, in fact the *de facto* method for individual and group communication within a company. Also, submission of electronic forms to replace the traditional paper procedures;
- Software distribution. New WWW products such as Java are suited for efficient updates of software products which will reach users upon demand through the internal network. That way all users can have the latest versions which will need only to be updated in the central server.

An important aspect of the intranet technology is that the above mentioned applications used by the various departments and groups in a company are provided through a single, simple and easy-to-use graphical interface based on hypertext. The common use just requires 'clicking' on reference links and buttons: what have been termed *end-user comfortable interfaces*, better suited to the inexperienced user's needs than those powerful *graphical interfaces* (Windows, for instance) whose whole functionality is barely and seldom explored by 90% of the normal users. Top managers are a good example of that sample as they are usually more prone to simple devices that require little expertise and quick learning.

5. Intranet vs. groupware solutions

Traditionally collaborative tasks in companies have been accomplished with commercial groupware products from well-known software suppliers such as Lotus, Novell or Microsoft, to mention only a few. The intranet approach is another alternative to them. Will it replace the existing groupware applications? Before answering that let us discuss the main differences between the intranet and the present groupware solutions (Ref 4):

(a) The intranet makes use of a technology based on open standards and protocols that run on diverse platforms (MS Windows, Unix, Apple Macintosh . . .). Groupware products are proprietary.

(b) Intranet solutions are scaleable; initial investments can be small and grow later on according to the users' needs, the required services and the available budget. Groupware solutions are generally sold as closed packages.

(c) Building an intranet is cheaper than installing a groupware package. There is plenty of freeware and shareware software (developed by and available through Internet sites) for servers, clients, HTML editing, etc. To give some figures: the entry level of the Lotus Notes client is about $70 per user whereas commercial Web browsers are in the $20 rank. As to the server, the start-up cost alone for an intranet solution can be as little as $1000, compared with $10 000 for a Lotus Notes product. In terms of ongoing costs, intranet solutions do not require dedicated leased lines, as was discussed in Section 3.

(d) Intranet documents are produced with the HTML language. There are a vast number of authoring tools available to assist users in document creation, many of them free through the WWW. With these tools document creation can now be the responsibility of content creators, thus freeing specialised information systems resources which are usually needed for the management of groupware applications.

(e) Intranet does not require *synchronised replication* across multiple servers which are needed in some groupware products in order to keep consistent information for the whole organisation. Instead a single server is enough, as was mentioned above.

(f) As an add-on value without additional cost, an intranet is a natural platform to access the outside world of the Internet.

Therefore commercial vendors are pondering whether to migrate from proprietary products to intranet solutions, or at least offering intranet compatibility. A double move is being witnessed now. Groupware companies are moving towards the intranet technology by including within their products HTTP, HTML editors, e-mail gateways, etc. On the other hand intranet technology is improving by including new features such as authoring tools (perhaps the weakest point of the intranet today as compared with groupware solutions) (Ref 5). The answer to the initial question about whether the intranet will replace the existing groupware applications is that it is not likely in the short term, at least for very specialised applications which may be critical for a company; some time and effort to implement it will be needed. In the medium or long term, those vendors are announcing fully-compatible intranet solutions which will be offered within their products. Therefore the posed question may not make sense any longer.

6. An intranet prototype. Fundesco's case

Fundesco is an organisation whose activities are centred about the IT world at large. In the late eighties a networking team designed and implemented the Spanish R&D Network known as *RedIRIS* which was managed

by Fundesco until the end of 1993. Since that time the networking people changed the initial network activities to other applications on the upper layers. Early in 1994 Fundesco set up one of the first WWW servers in Spain containing relevant information about Fundesco's goals, activities and publications, including an electronic bookshop. Fundesco's Documentation Centre had several BRS databases; thus a BRS/WWW gateway was designed and implemented to allow an easier and more friendly access to the databases. That was possible not only for Fundesco's employees but also for external users who could access into that information via the Internet. That system has been working rather successfully for the past two years and has proved to be a proper tool for information searching.

Based on the former system a new development has started in 1996. The aim is to move to a complete digital environment that includes, in addition to the possibilities of the present version for information searching, the actual contents of documents in graphical format as well as other content types such as images, voice and video-clips. As a matter of fact one has seen that documentation centres have established databases not only for cataloguing purposes but also to allow information searching by indexing and related means. This approach is scaleable but has certain limitations such as:

- it is text-oriented and not suitable for the increasing multimedia contents;
- contents is lacking of characterisation;
- user interfaces are too much dependant on specific commercial products, and not friendly enough for the normal user;
- graphical representation is poor compared with the capabilities of today's PCs and workstations.

On the other hand there is a trend to replace information on printed materials by digital formats.

Thanks to its multimedia capabilities and hypertextual representation, the Web model (and the corresponding technologies) is the obvious option to publish and distribute Fundesco's corporate information. Document contents can thus be represented in a standard way according to the MIME (*Multimedia Internet Mail Extensions*) conventions used in the WWW model. The goal is to develop a system in order to automate the process shown in Figure 2. Paper will be progressively suppressed and, at the same time, other information formats such as sound, images and video will be incorporated. The system is highly portable as it is based on open standards (Unix and intranet), so that it can be adapted both to small documentation centres and to large libraries.

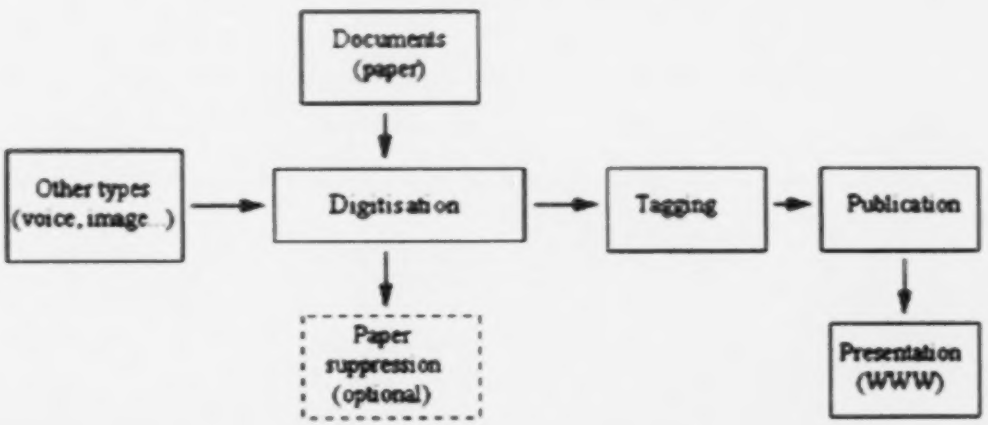

Figure 2

Figure 3 shows the different parts and the overall scheme. The *input interface* will capture the analogue information to convert it to digital format. It is composed of a high-resolution scanner and a Unix workstation connected to it. There is also a digital audio system and an analogue video card which can digitalise and MPEG compress. The tagging process, that is the association of contents (to be stored in a repository) and the corresponding documents, is accomplished at the workstation. Tags are objects that point to the document contents in the repository; they also include additional characteristics needed to present each document. The other part of the system is the *access interface* to the information. It is a BRS database system and a WWW server, both parts linked by the BRS/WWW gateway discussed above.

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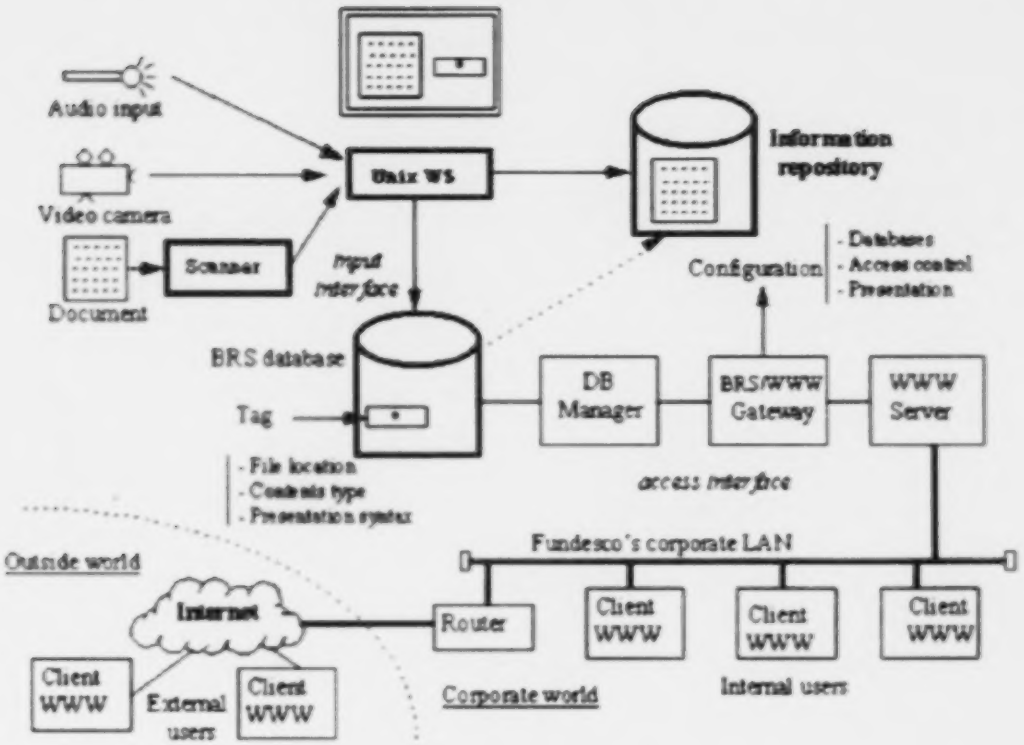

Figure 3

When a document is scanned the workstation captures it in digital format and stores it in the repository; a tag is created and inserted in the database where the bibliographic reference (as it was previously catalogued) is located. Therefore document and contents are related by the tag, although they reside physically in different parts. End-users interact with the database system via their WWW client and the gateway. Thus they need not be concerned with BRS native commands or other implementation details. At the gateway there are access control mechanisms to the database for Fundesco's employees. Documents can be searched via WWW user-friendly forms; once the required document is located users can visualise parts of it (pages), as well as other types of information such as video, audio, etc., and certainly the textual information corresponding to the original catalogue record.

In summary the system functionality is such that:

- in addition to the original catalogue record, tags show where the digitised file is located, the type of contents (text, image, voice . . .) and the presentation syntax;
- e-mail and personal Web pages of authors can be included as hyperreferences in the multimedia documents;
- home pages of document publishers can also be included in the same fashion;
- the multimedia archive system being built can be accessed through WWW hypertext, and the amount of storage space for paper can significantly be reduced;
- inexperienced users (in practice most of all the employees) have at hand a common and friendly interface;
- the system is highly portable for various platforms and systems, as the implementation is based on open standards and proven technology (Internet, intranet).

The first half of the project (March–August 1996) encompasses six months. Goals for this phase are to develop a prototype for the manual tagging of contents, the creation of tags and the manual insertion of those into the database. The digitised information will be published automatically through the WWW, as it was originally implemented but adding now the ability to handle tags (for multimedia contents) with other new features such as more flexible mechanisms for configuration, security and presentation. The second half (September 1996–February 1997) will yield a true production system. At that stage tags will be generated automatically and inserted into the database system, thus allowing instantaneous publication of documents as soon as they are scanned. It is intended too to develop a generalised interface to interact with different database systems

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(documentary or other types) to be used by documentation centres, libraries and the like.

This project is an example of how an organisation can use the existing Internet technologies to build up practical intranet solutions. Fundesco's employees will have simple and easy access to the multimedia information of the Documentation Centre from each desktop on the corporate TCP/IP LAN through a common WWW browser.

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